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EXAMINER

CECIL, TERRY K

ART UNIT	PAPER NUMBER
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1723

MAIL DATE	DELIVERY MODE
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05/01/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/761,746

Applicant(s)

VALBJOERN ET AL.

Examiner

Mr. Terry K. Cecil

Art Unit

1723

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 March 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date one.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

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DETAILED ACTION***Claim Rejections - 35 USC § 102***

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

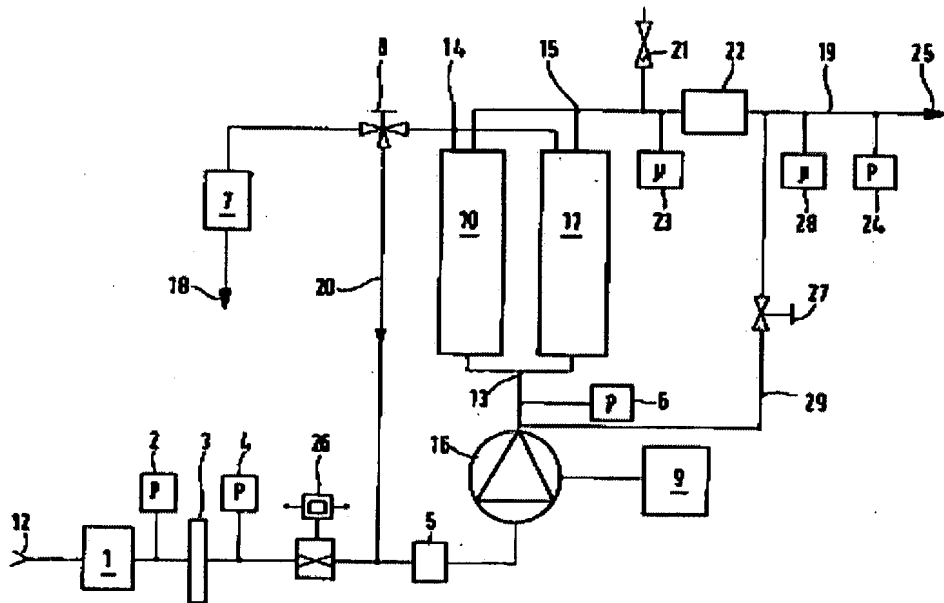
A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(c) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 9 and 12 are rejected under 35 U.S.C. 102(a) as being anticipated by DE 10112725 A1, hereinafter '725.



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In accordance with customer demand (pressure and permeate purity) at 25, a fluid pump 16 is controlled by a control device 9 that receives input from quality sensors 1, 23 and 28 and pressure sensors 2, 4, 6, and 24.

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

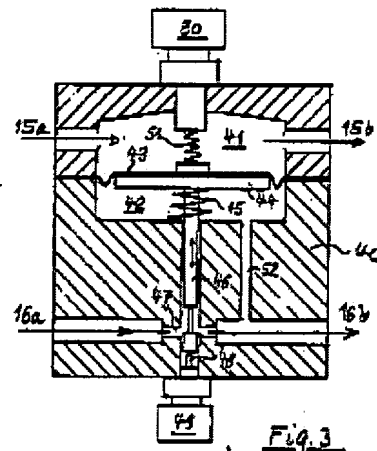
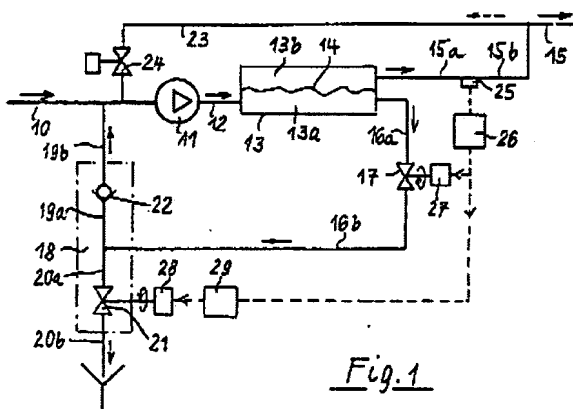
A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1-7 and 13-14 are rejected under 35 U.S.C. 102(b) as being anticipated by the German Reference DE 19520912 A1, hereinafter '912.



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'912 teaches a water filtration device wherein pressure on the primary side of the diaphragm depends on the pressure on the secondary side. This is accomplished by pressure control device 40 including valve element 44 responding to the pressure difference between the concentrate and permeate conduit communicating the respective sides of the diaphragm unit [as in claims 1-2].

As for claim 3, line 15 is connected to the consumer inlet. As for claim 4, the control valve exists in the recycle line made up of conduits 16a, 16b, and 19b which is between the diaphragm unit and the pump 11 (or the pump and diaphragm unit in a direction opposite the flow). As for claim 5, when the pressure on the secondary side is lower than the primary side the valve is acted upon to move in an opening direction and vice versa for the primary side closing action (a negative pressure still "acts upon" the element resulting in movement thereof). As for claims 6-7, device 18 communicates with the primary side and includes parallel valves (21,22).

As for claims 13-14, elements 49 and 50 that control the force on the valve element are considered to be part of the control device and act to "sets" the pressure drop across the diaphragm.

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Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. Claim 8 is rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over DE4331102, hereinafter '102. '102 teaches a diaphragm unit wherein the pressure on the permeate side is kept constant by regulating with element PR a fluid pump. '102 doesn't specify the pressure of the secondary side. However, the examiner contends that the manner of operating the device DOES NOT DIFFERENTIATE APPARATUS CLAIMS FROM THE PRIOR ART. See MPEP 2114 [R-1]. Alternately, structurally configuring the system to have the ability to maintain such a pressure on the secondary side would be within ordinary skill depending upon the desired operation of the dialysis system (the consumer device).

7. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over '725. Although the pressure range limitations are more conducive to a method, it is contended that configuring

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the system to operate at certain pressures at differing qualities of water is within ordinary skill and depends upon the environment in which it is used and the demands of the consumer.

8. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over '912 in view of knowledge of one ordinarily skilled in the art or alternately in view of '997. It is considered that it would have been obvious to one ordinarily skilled in the art at the time of the invention to have a check valve in the consumer line since such would prevent return flow contamination of the diaphragm (such a check valve is also known in the art of '997, e.g. "39").

Response to Arguments

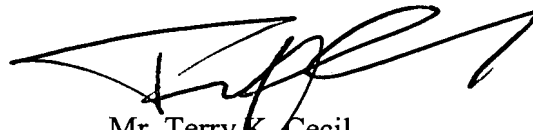
9. Applicant's arguments filed 3-29-2007 have been fully considered but they are not persuasive.

- Final rejection was withdrawn.
- English [machine] translations available to the public at the EPO website are attached hereto. Full English translations have been ordered.
- Concerning '912, an increase of fluid pressure at 12 would necessarily increase the pressure acting on the valve element (in the concentrate line) such that pressure on the primary side acts upon the valve element, as required by claim 1. The claim does not require the same pressure value nor does the valve element have to be positioned downstream of the pump/upstream of the diaphragm unit.

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10. Contact Information:

- Examiner Mr. Terry K. Cecil can be reached at (571) 272-1138 at the Carlisle campus in Alexandria, Virginia for any inquiries concerning this communication or earlier communications from the examiner. Note that the examiner is on the increased flextime schedule but can normally be found in the office during the hours of 8:30a to 4:30p, on at least four days during the week M-F.
- Steve Griffin, the examiner's supervisor, can be reached at (571)272-1189 if attempts to reach the examiner are unsuccessful.
- The Fax number for this art unit for official faxes is (571) 273-8300.
- Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Mr. Terry K. Cecil
Primary Examiner
Art Unit 1723

TKC
April 29, 2007

OFFICE ACTION ATTACHMENT

esp@cenet document view

<http://v3.espacenet.com/textdoc?DB=EPODOC&IDX=DE1011272...>

Modular reverse osmosis water treatment assembly has regulator varying water output in accordance with demand

Publication number: DE10112725

Publication date: 2002-10-02

Inventor: MICHELBACH LUDWIG (DE)

Applicant: MICHELBACH LUDWIG (DE)

Classification:

- International: B01D61/08; B01D61/10; B01D61/12; C02F1/44; B01D61/02; C02F1/44; (IPC1-7): B01D61/12

- European: B01D61/08; B01D61/10; B01D61/12

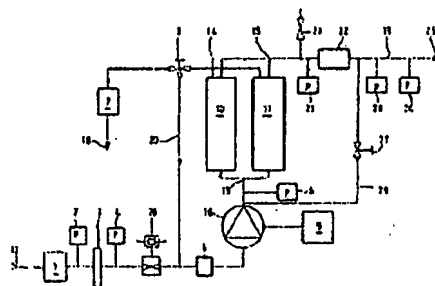
Application number: DE20011012725 20010314

Priority number(s): DE20011012725 20010314

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Abstract of DE10112725

A modular (10,11) reverse osmosis water treatment assembly has a water inlet (13) with a concentrate outlet (14) and a treated water outlet (15). Water is supplied to the treatment module by a pump (16) with especially a regulator (9) which maintains the water pressure at a level proportional to the water outlet pressure. Water outlet pressure can be adapted in accordance with consumer demand. The pressure regulator has a frequency converter regulating pump pressure in the range 1 to 80 bar. The outlet pressure is monitored by a sensor (24). Water hardness is monitored (1) at the inlet (12). The supply of incoming water is stopped if hardness exceeds a given value. The modules may be operated jointly or separately.



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The invention concerns a reverse osmosis plant in accordance with the generic term of the patent claim 1.

Water can be almost completely entsalzt by a reverse osmosis procedure. The advantage of this procedure is particularly in the small environmental impact. For this procedure no chemicals are necessary.

In this way entsalztes water is used in particular in the industry, pharmacy and in hospitals. Also for the air humidification in ventilation and air conditioning systems a in this way entsalztes water is often used. Further reverse osmosis plants for the dressing can be used by sea water. Sea water is unsuitable because of the high Salzgehalts as drinking water. With the help of a reverse osmosis plant the Salzgehalt can be reduced by sea water so far that it is suitable as drinking water. Such plants are needed in particular in coastal regions with few or no fresh water occurrence.

From the state of the art a reverse osmosis plant is well-known, which is upstream a Enthärtungsanlage. In this Enthärtungsanlage Rohwasser on less than 1 DEG is decalcified dH. The exit of the Enthärtungsanlage is coupled with the entrance of the reverse osmosis plant. At the entrance the reverse osmosis plant exhibits a pump, which presses the demineralized water with a pressure from approximately 10 bar to 80 bar by modules. In the modules the actual reverse osmosis procedure takes place, as the water with pressure is pressed against halfpermeable diaphragm. Salts and/or minerals become filtered, whereby the Rohwasser splits up into a Permeat (Diluut) and a concentrate. The Permeat (Diluut) is further usable as particularly salt-poor water. The concentrate is a waste product and is rejected. Usually a module in approximately 75% Permeat (Diluut) and 25% concentrate produces. The pumping jerk as well as the Permian RK and concentrate quantity are manually adjustable. The Permeat is stored in a pressure-free container and further-pumped from there to a final consumer.

This conventional reverse osmosis plant has the disadvantage that the water in the container can bud. This is to be attributed in particular to the fact that the container is never completely close and the water often longer time remains in the container. By a heating up of the water in the container, in particular in the summer, budding is additionally promoted. For the prevention of the germinating UV lamps, chemicals or additional lines, is used which however the energy expenditure, which environmental impact and the constructional expenditure increase.

A further important disadvantage is caused by the switching on phase of the reverse osmosis plant. During this switching on phase the water has a substantially higher conductance, about 150 to 200 $\mu\text{S}/\text{cm}$, than desired. Further the conventional reverse osmosis plant has a relatively high space requirement. Finally the manual attitude of important sizes entails unwanted inaccuracies.

It is task of the invention to place a reverse osmosis plant ready which overcomes the disadvantages specified above.

This task is solved by the article in accordance with patent claim 1.

▲ top It is according to invention intended that at the pump or between pump and raw water entrance a pressure control mechanism is intended, which stops a raw water pressure PR as a function of a pre-determined Diluatdruck PD at the Diluatausgang. In at least one module only as much Rohwasser is supplied by this measure, as an appropriate quantity of salt-poor Diluat of the Diluatausgang is needed. No surplus Diluat is thus produced. Therefore also no container is necessary, in which the Diluat could bud. Just as little a booster pump is necessary, since the necessary pressure is already made available by the pump, which is upstream the module. By being omitted the container and the booster pump also the constructional expenditure of the entire plant is reduced.

In particular it can be intended that the pressure control mechanism covers a frequency converter for the control of the pump in such a manner that the pump is adjustable by 10-80 bar in particular over a continuous pressure range. The use of the frequency converter makes a lossless regulation possible. Only that energy is supplied to the pump, which is actually needed. No surplus energy is converted into warmth.

Further it can be intended that for the collection of the Diluatdruckes PD a pressure sensor at the Diluat line system arranged at the Diluatausgang is intended. By a such placing of the pressure sensor a particularly exact printer version is possible. In particular in the Diluat line system the current is essentially laminar, so that measuring errors remain very small.

In addition it can be intended that for the controlling of the pump by means of the pressure control mechanism in addition to the Diluatdruck PD the raw water pressure pn existing at the raw water entrance is considered. Thus the pressure control mechanism can react also to fluctuations of the raw water pressure PR. In this way the pressure at the exit of the pump is stopped particularly exactly.

Finally a concentrate feedback can be intended, in order to lead the concentrate withdrawing at the concentrate exit totally or partly again by the reverse osmosis module. The regulation possibilities of the entire plant are increased by this measure. In particular the electrical conductance can be stopped by Diluat and concentrate according to the

requirements.

It can be intended that the concentrate feedback covers a reconducting valve, which leads a certain part of the concentrate as a function of the desired Diluatmenge and/or the Jonenkonzentration IC of the Diluats by the concentrate feedback. Thus also the ion concentration IC can be stopped to a constant value.

Further characteristics, advantages and arrangements of the invention are the subject of the Unteransprüche.

A preferential execution form of the invention is more near described below on the basis the attached design.

The only figure shows a block diagram of the preferential execution form of the reverse osmosis plant according to invention.

The reverse osmosis plant exhibits an entrance 12. This entrance 12 are downstream in row a degree of hardness control device at the outlet side 1, a first pressure sensor 2, a filter 3, a second pressure sensor 4, a single solenoid valve 26, a push button switch 5 and a pump 16. A third pressure sensor 6 is assigned to the exit of the pump 16. Further the pump 16 exhibits a control inlet, which is coupled with a frequency converter 9. The exit of the pump is coupled with a raw water entrance of 13 two parallel switched reverse osmosis modules 10 and 11. In addition the reverse osmosis modules 10 and 11 exhibit a concentrate exit 14 and a Diluatausgang 15. The concentrate exit 14 a regulating valve 8 is downstream. The regulating valve 8 exhibits two exits. Exit of the regulating valve 8 is connected by a return line 20 with the crosspoint of the push button switch 5 and the single solenoid valve 26. The other exit of the regulating valve 8 is connected by a water meter 7 with a concentrate discharge 18. The Diluatausgang 15 are downstream a tapping cock 21, a first conductance sensor 23, a second water meter 22, a second conductance sensor 28, a fourth pressure sensor 24 and a Diluatabfluss 25, which connected by a Diluatleitungssystem is 19. The Diluatleitungssystem 19 is connected by a bypass line 29 with the exit of the pump 16. The bypass line 29 exhibits a second regulating valve 27.

By way of the entrance 12 Rohwasser is supplied to the reverse osmosis plant, which was usually decalcified in a Enthärtungsanlage. The degree of hardness control device 1 is intended to seize the degree of hardness of the Rohwassers so that during excess of a pre-determined limit value the further supply can be prevented by Rohwasser, for example by latches of the single solenoid valve 26, automatically or manually. Preferably during an excess of the value 1 DEG is switched off automatically dH the reverse osmosis plant. In this way it is prevented that water with a higher degree of hardness arrives into the reverse osmosis modules 10 and 11. This would have the consequence that the reverse osmosis modules 10 and 11 would be clogged, and in the long run the entire reverse osmosis plant would fail. By the use the degree of hardness control device 1 is substantially reduced all maintenance costs of the plant. The single solenoid valve 26 can be closed with the switching of the plant off, in order to make for example a rinsing possible of the plant.

The pump 16 is in addition intended, the Rohwasser with pressure, usually between 10 and 80 bar to press into the reverse osmosis modules 10 and 11. The pump 16 is headed for by the frequency converter 9. The frequency converter 9 preferably an DDC automatic controller is upstream. The pressure at the exit of the pump 16 is regulated as a function of those values, which by the third pressure sensor 6, which second water meter 22, the conductance sensor 23 and the fourth pressure sensor 24 are seized. In this way the pump 16 is regulated in such a manner that is supplied to the reverse osmosis modules 10 and 11 as much Rohwasser, as Diluat at the Diluatabfluss 25 is needed by a final consumer. A temporary storage of the Diluats in a container or such a thing is not necessary. Thus a germ formation is prevented, which often arises in such containers. Preferably the reverse osmosis modules 10 and 11 are separately and disconnectible. In this way can as a function of the demanded Diluatmenge, in particular with still more modules, which are regulated entire plant.

The regulating valve 8 is trained as 2-Wege-Ventil. With the regulating valve 8 can be adjusted, which portion of the concentrate is reducted over the return line 20 to the advance of the pump 16. For example the regulating valve 8 can be headed for by an DDC automatic controller. The remaining portion of the concentrate is supplied to the concentrate discharge 18 by way of the first water meter 7. That the concentrate discharge 18 supplied concentrate is usually rejected as waste. The regulation possibilities of the entire reverse osmosis plant are increased by the adjustable feedback of the concentrate. In particular thereby the concentrate is constantly adjustable.

The bypass line 29 and the second regulating valve 27 form components of a blending mechanism with the execution form described here. Thus in particular the reverse osmosis modules 10 and 11 are bridged, so that a part of the filtered Rohwassers can be supplied directly to the Diluatleitungssystem 19 and the Diluatabfluss 25. Thus a further regulation possibility is made available for the reverse osmosis plant. A part of the filtered Rohwassers can be supplied thereby on the two reverse osmosis modules 10 and 11 to the Diluatabfluss 25 past, if by the final consumer an appropriate pre-determined Salzgehalt is tolerated. Preferably the current conductance of the blended Diluats is seized by the second conductance sensor 28. Depending upon Salzgehalt tolerated by the final consumer then the relationship of from the reverse osmosis modules 10 and 11 spent Diluatfluss and the filtered Rohwassers led by the bypass line 29 can be stopped manually or automatically by means of the regulating valve 27. Further it can be favourable to seize additionally also the current conductance of the Diluats before blending with filtered Rohwasser, spent from the reverse osmosis modules 10 and 11, in the first conductance sensor 23. The regulation can be improved thereby since on the basis the quality of the Diluats spent from the reverse osmosis modules 10 and 11 the presumed possible addition of filtered Rohwasser can be measured over the bypass line 29. An examination can take place then still via determination of the conductance of the blended Diluats in the second conductance sensor 28. This procedure is particularly economic, since by the two reverse osmosis modules 10 and 11 no more water than necessarily through one carries. This affects itself favorably for the Wartungsintervalle of the reverse osmosis modules 10 and 11.

With the blending mechanism a further possibility is created of adapting the constructional and technological expenditure for the reverse osmosis plant optimally to the available in each case requirements. The bypass line 29 and the second regulation valve 27 are economical construction units, which in addition small maintenance costs require. By the blending mechanism the flow rate of the two reverse osmosis modules can be substantially smaller 10 and 11 than those the entire reverse osmosis plant.

In particular it is intended that the reverse osmosis plant can be coupled with an EDP equipment. The seized measured values of all sensors of the EDP equipment are supplied. On the basis of these measured values the frequency converter 9 and the regulating valve 8 are headed for by the EDP equipment. In this way a constant monitoring of the reverse osmosis plant is possible by means of the EDP equipment. A display of the EDP equipment is intended for the constant optical monitoring of the most important measuring data. A permanent recording of the seized measured values is likewise intended. The EDP equipment can be realized by means of PC economically. For example also a SPS control can be used. All data and possible incidents can be passed on directly and immediately to a directing center. Further it is pointed out that the plant according to invention has a very small space requirement. Finally the DIN 6022 relevant for germ formation can be kept problem-free with this plant. Also the DIN relevant in accordance with the drinking water regulation 2000, which likewise concerns the germ formation, can be fulfilled with the reverse osmosis plant according to invention.

The reverse osmosis plant according to invention can be used in the industry. For numerous manufacturing processes and products water with a low Salzgehalt is needed. In particular for the Pharma industry these reverse osmosis plant is favourably suitable. Apart from the extremely low Salzgehalt also the germ formation is very small, which is important for pharmaceutical products in particular. Also in hospitals the reverse osmosis plant according to invention can be used, where likewise the low germ formation apart from the low Salzgehalt plays an important role. Finally the reverse osmosis plant according to invention can be used as sea water dressing plant, so that drinking water can be won in this way. In coastal regions, which exhibit only small fresh water occurrence, the reverse osmosis according to invention plant can be used particularly efficiently for the supply by drinking water.

Reference symbol list

- 1 degree of hardness control device
- 2 first pressure sensor
- 3 filter
- 4 second pressure sensor
- 5 push button switches
- G third pressure sensor
- 7 first water meter
- 8 first regulating valve
- 9 frequency converters
- 10 reverse osmosis module
- 11 reverse osmosis module
- 12 entrance
- 13 raw water entrance
- 14 concentrate exit
- 15 Diluatausgang
- 16 pump
- 18 concentrate discharge
- 19 Diluatleitungssystem
- 20 return line
- 21 tapping cock
- 22 second water meter
- 23 first conductance sensor
- 24 fourth pressure sensor
- 25 Diluatabfluss
- 26 single solenoid valve
- 27 second regulating valve
- 28 second conductance sensor
- 29 bypass line



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1. Reverse osmosis plant for Rohwasser, in particular city or Brunnenwasser, for the production of salt-poor Diluat or Permeat, comprehensively

- at least one reverse osmosis module (10, 11) with a raw water entrance (13), a concentrate exit (14) as well as a Diluatausgang (15) and

- a pump (16), subjecting the reverse osmosis modules (10, 11) with the Rohwasser, by the fact characterized that

at the pump (16) or between pump (16) and raw water entrance (13) a pressure control mechanism (9) is intended, which stops a raw water pressure PR as a function of a pre-determined Diluatdruck PD at the Diluatausgang (15), whereby the pre-determined Diluatdruck PD is adaptable to the requirements of connect at the outlet sidable consumers.

2. Reverse osmosis plant according to requirement 1, by it characterized that the pressure control mechanism covers a frequency converter (9) for the control of the pump (16), in such a manner that the pump (16) is adjustable over a continuous pressure range, in particular from 10 to 80 bar.

3. Reverse osmosis plant according to requirement 1 or 2, by the fact characterized that for the collection of the Diluatdruckes PD a pressure sensor (24) at the Diluatausgang (15) is divert-laterally to the Diluatausgang (15) arranged Diluat line system (19) intended or at one.

4. Reverse osmosis plant after one of the requirements 1 to 3, by the fact characterized that for the controlling of the pump (16) by means of the pressure control mechanism in addition to the Diluatdruck PD the raw water pressure PR existing at the raw water entrance (13) is considered.

5. Reverse osmosis plant after one of the requirements 1 to 5, by the fact characterized that the reverse osmosis plant at the entrance (12) exhibits a degree of hardness control device (1), in order to stop the raw water supply during excess of a pre-determined degree of hardness.

6. Reverse osmosis plant after one of the requirements 1 to 5, by the fact characterized that the reverse osmosis modules (10, 11) are separately and disconnectible.

7. Reverse osmosis plant after one of the requirements 1 to 6 to lead thereby characterized that a concentrate feedback (20) is intended, in order the concentrate withdrawing at the concentrate exit (14) totally or partly again by the reverse osmosis module (10, 11).

8. Reverse osmosis plant according to requirement 7, by the fact characterized that the concentrate feedback (20) covers a regulating valve (8), which leads a certain partial amount of the concentrate depending upon the Diluatmenge requested by the final consumer and/or depending upon the ion concentration IC reached in the Diluat by the concentrate feedback (20).

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9. Reverse osmosis plant after one of the requirements 1 to 8, by the fact characterized that the reverse osmosis plant covers a bypass line (29) with a second regulating valve (27), which is switched between the exit of the pump (16) and the Diluat line system (19).



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The invention concerns a reverse osmosis plant for the production of Permeat, in particular for dialysis. Such reverse osmosis plants serve the dressing of the dialysis water in hemodialysis stations v hospitals.

Core of a reverse osmosis plant is a reverse osmosis module with a semipermeable diaphragm. Tap water is supplied to the module, in which substances are solved like inorganic salts. In order to produce from the supplied Rohwasser the necessary pure water, by means of a high-pressure pump on side is applied the diaphragm a hydrostatic pressure, which is larger than the osmotic pressure in the Rohwasser. In reversal of the procedure of the natural osmose diffuses thereby solution with - thus the pure water - by the diaphragm through, while on the other side of the system the substances loosened in the water up-concentrate. In such a way produced pure water is called Permeat, the up-concentrated solution as concentrate.

Reverse osmosis plants, which are particularly appropriate for medical purposes, should not be equipped with supply or buffer tanks, in order to avoid flowless neutral zones if possible and to keep the germinating risk small. In dialysis stations neutral zone-free ring circuits are therefore shifted, in which the produced Permeat constantly flows in the circle u is as required taken.

In a dialysis station the need of Permeat varies very strongly. Between rinsing phase of the attached dialysis devices and fluctuations up to 75 per cent can occur to gradual slopes of the patients after the treatment. Usually the reverse osmosis plant only with 60 to 70 per cent of its power limit is operated. A part of the running off concentrate can be reconducted over a return line to the pump and be fed again into the reverse osmosis module, whereby energy is saved. Surplus concentrate, which cannot be reconducted, must be led however into the discharge. Bedeut that a not insignificant portion of the drinking water taken out of the supply is rejected useless as concentrate.

The system efficiency of a reverse osmosis plant of the kind here in speech is defined by the relationship between the quantity of the produced - and taken - Permeats and the inlet quantity of Rohwasser. The available invention is the basis now the task to increase the system efficiency of a reverse osmosis plant attached to a ring circuit.

With the solution of this technical problem proceeded from a reverse osmosis plant with a supply for uncleaned Rohwasser, a semipermeable diaphragm containing reverse osmosis module, a pump arranged between supply and reverse osmosis module for the setting up a high hydrostatic pressure before the diaphragm, one at the output to the reverse osmosis module attached ring circuit, a return line for the feedback of running off concentrate to the pump and a discharge for surplus concentrate. Such, in particular for dialysis stations suitable reverse osmosis plant is for example well-known from de European Union 0,436,098 a2.

The technical problem posed is solved by the characteristic characteristics of the patent claim 1 as well as the similar process steps of the patent claim 4 directed toward the indication of a procedure for the regulation of a reverse osmosis plant of the mentioned kind.

For the adjustment of the system efficiency to the current operating situation two according to invention separate controlling means are intended. The pump regulation regulates the engine performance of the pump in dependence of the measured values of the associated pressure sensor in such a way that a decrease of pressure in the ring circuit becomes balanced immediately due to the withdrawal of Permeat, whereby the pressure in the ring circuit is kept constant. The concentrate regulation steers the arranged regulating valves in the return line in dependence of the signals on the flow sensors and/or. before the discharge so that the maximally permissible quantity of rushing over concentrate is always reconducted to the pump and if possible little is led into the discharge. The reverse osmosis plant regulated in accordance with the invention is characterised by an optimized system efficiency, i.e., it always straight so much Permeat is produced, as is taken by the dialysis station out of the ring circuit. In order to achieve as long a service life of the semipermeable diaphragm as possible, the plant D is operated only up to a certain system efficiency, which depends on the quality of the approaching Rohwassers.

A further refinement of the regulation characteristic can be achieved, if additionally the hydrostatic pressure before the diaphragm of the reverse osmosis module is measured and supplied to the concentrate regulation as the further Steuergröße. A increased working reliability results, if in addition the quantity of the taken Permeats constantly by means of a flow sensor planned at the ring circuit seized and thus supervises we

Although the pump regulation and the concentrate regulation are instrumentation from each other independent, a mutual influence arises as a result of the physical parameters pressure and flow rate. For example if the Pumpenleistung is increased due to the withdrawal by Permeat from the ring circuit, as a result of it obligatorily a increased liquid throughput arises, to the concentrate regulation reacted. In favourable further training of the invention therefore the quantities become reconducted and/or. rejected concentrate and the regulation of the pump by means of a family of characteristics so one on the other co-ordinated that the relationship between the quantity of the approaching Rohwassers and the Permeats taken out of the ring circuit is always as large as possible.

A remark example of the invention is more near described below on the basis the attached designs. Show:

Fig. 1 a reverse osmosis plant for a dialysis station in a highly simplified principle picture;

Fig. 2 the regulation of the plant of Fig. 1.

In Fig. 1 schematically represented reverse osmosis plant is supplied uncleaned Rohwasser by way of a supply too from the drinking water pipeline. Core of the plant is a reverse osmosis module UOM, whose semipermeable diaphragm separates the running off concentrate from the Permeat through-diffused by the diaphragm. Between supply too and Umkehrosmo module UOM is arranged a pump P, which develops a high hydrostatic pressure before the diaphragm. A ring circuit Ri is at the output connected with the Umkehrosmosen UOM, out of which the attached dialysis devices take as required Permeat. Running off concentrate arrives over a return line Rü at the pump P back. Surplus concentrate that not to be reconducted can, into a discharge is led off.

In the ring circuit Ri is intended a pressure sensor P1, which seizes the pressure fluctuations in the ring circuit due to Permeatentnahme. With this pressure sensor P1 an electronic pump regulation PR stands in effect connection. This regulates the engine performance of the pump P in such a way that the pressure remains as constant as possible in the ring circuit Ri.

▲ top In the return line Rü is intended a first flow sensor S1, which seizes the quantity of the concentrate reconducted to the pump P. A second flow sensor S2 seizes the quantity into the discharge starting from led concentrate. The two flow sensors S1 and S2 is in each case a regulating valve V1 and/or. V2 assigned. The quantity of the reconducted concentrate and the quantity of the rejected concentrate steers an electronic concentrate regulation KR standing with the two flow sensors S1 S2 as well as the two regulating valves g 1 and R2 in effect connection. An additional pressure sensor P2 measures the hydrostatic pressure before the diaphragm of the reverse osmosis module and emits an appropriate signal as the further Steuergrösse to the concentrate regulation KR.

A further, flow sensor S3 intended at the ring circuit Ri actually seizes those for dialysis purposes inferred quantity of Permeat. This value is supplied to a control member ÜE, which supervises the entire plant.

The regulation of the plant on the basis given actual values and the seized being clarifies the diagram of Fig. 2.

The pump regulation PR reacts to a deviation of the actual pressure in the ring circuit Ri, measured by the pressure sensor P1, from the given target pressure by an increase of the engine performance of the pump P1 and with it the hydrostatic pressure before the diaphragm of the reverse osmosis module U

The concentrate regulation KR reacts to deviations of the actual quantity of the reconducted concentrate measured by the flow sensor S1 and/or. the actual quantity over the discharge starting from rejected concentrate of the appropriate given being. The two regulating valves V1 and are steered accordingly.

The pump regulation PR and the concentrate regulation KR are co-ordinated by means of a family of characteristics so that the relationship between the quantity of the approaching Rohwassers and the taken Permeats is as large as possible. This is to describe the following example: A reverse osmosis plant, which can produce litres of Permeat per hour up to 1000, supplies a dialysis station, which needs only 500 litres per hour. The pump regulation PR regulates therefore the engine performance of the pump P on approximately half of its rated output down. The hydrostatic pressure within de Umkehrosmosemoduls UOM adjusts itself thereby to 50 to 60 per cent of the maximally permissible operating pressure. For this pressure range there is an optimal value for the quantity of Konzentrat. Um a system efficiency, by-flowing at the semipermeable diaphragm, from 90 per cent to achieve to, may in this case of at the most 46 litres concentrate per hour into the discharge be led off. The pump regulation PR steers the regulating valves V1 and V2 in such a way that the given relationship between reconducted and rejected concentrate adjusts itself. Furthermore the concentrate regulation must consider the boundary condition that at least 800 litres concentrate per hour from the reverse osmosis module UOM must flow off, in order to protect the sensitive diaphragm against a over concentration and failing salts. Reference symbol list to supply

UOM reverse osmosis module
P pump
Ri ring circuit
Rü return line
Starting from discharge
P1 pressure sensor (at Ri)
P2 pressure sensor (at UOM)
S1 flow sensor (in Rü)
S2 flow sensor (forwards off)
S3 flow sensor (in Ri)
V1 regulating valve
V2 regulating valve
PR pump regulation
KR concentrate regulation
ÜE control member



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1. Reverse osmosis plant for the production of Permeat, in particular for dialysis, comprehensively

- a supply for uncleaned Rohwasser;
- a reverse osmosis module with a semipermeable diaphragm, which separates the concentrate from the Permeat;
- a pump arranged between supply and reverse osmosis module for the setting up a high hydrostatic pressure before the diaphragm;
- one at the output to the reverse osmosis module attached ring circuit, out of which constantly as required Permeat is taken;
- a return line for the feedback of running off concentrate to the pump;
- a discharge for surplus concentrate;

marked through

- a pressure sensor (P1) to the measurement of the pressure in the ring circuit (Ri);
- an electronic pump regulation (PR), standing with the pressure sensor (P1) in effect connection, to the regulation of the engine performance of the pump (P);
- a first flow sensor (S1), which seizes the quantity of the concentrate reconducted to the pump (P);
- a second flow sensor (S2), which seizes the quantity of the concentrate led into the discharge (off);
- a first regulating valve (V1) in the return line (Rü);
- a second regulating valve (V2) before the discharge (off);
- with the two flow sensors (S1) and (S2) as well as the two regulating valves (V1) and (V2) in effect connection standing electronic concentrate regulation (KR) to the controlling of the quantity of the reconducted concentrate and the quantity of the rejected concentrate.

2. Reverse osmosis plant according to requirement 1, characterized by an additional, on the reverse osmosis module (UOM) intended and pressure sensor (P2), standing with the concentrate regulation (KR) in effect connection, to the measurement of the hydrostatic pressure before the diaphragm.

3. Umkehrosmoseanlage according to requirement 2 or 3, characterized by a third, at the ring circuit (Ri) intended flow sensor (S3) to the collection of the quantity of the taken Permeats.

4. Procedure for the regulation of a reverse osmosis plant in accordance with the generic term of the patent claim 1, characterized by the process steps:

- Fairs of the pressure in the ring circuit;
- Seizing the quantity of the concentrate reconducted to the pump;
- Seizing the quantity of the concentrate led into the discharge;
- Controlling of the quantity of the reconducted concentrate and the quantity of the rejected concentrate;
- Regulation of the engine performance of the pump in dependence of the pressure in the ring circuit and the quantities of reconducted and/or. rejected concentrate.

5. Procedure according to requirement 4, by the fact characterized that the hydrostatic pressure before the diaphragm of the reverse osmosis module is measured and supplied to the concentrate regulation as Steuergrösse.

6. Procedure according to requirement 4 or 5, by the fact characterized that the quantity of the Permeats taken out of the ring circuit is seized.

7. Procedure after one of the requirements 4 to 5, by the fact characterized that the controlling of the quantities of reconducted and/or. rejected concentrate and the regulation of the pump by means of a family of characteristics to be so co-ordinated that the relationship between the quantity of the approaching Rohwassers and the Permeats taken out of the ring circuit is always as large as possible.

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Reverse osmosis system and method for controlling a reverse osmosis system**Publication number:** DE4331102**Publication date:** 1995-03-16**Inventor:** WALTHER KARL (DE); TAIBON ULRICH (DE); HERBERGER JOSEF (DE); BÄLTHER INES (DE)**Applicant:** WALTHER MEDIZIN TECHNIK GMBH (DE)**Classification:**

- international: B01D61/12; C02F1/44; A51M1/16; B01D61/02; C02F1/44; A51M1/16; (IPC1-7): C02F1/44; A51M1/16; B01D61/12; G01F1/00; G05D21/00

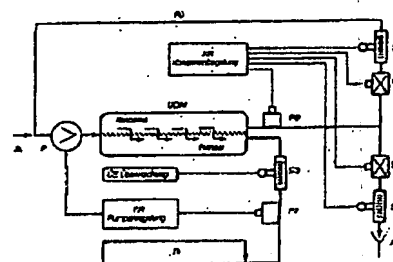
- European: B01D61/12; C02F1/44B

Application number: DE19934331102 19930914**Priority number(s):** DE19934331102 19930914

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Abstract of DE4331102

A reverse osmosis system for producing permeate for dialysis comprises a supply (Zu), a reverse osmosis module (UOM) with semipermeable membrane, a pump (P), a ring line (Ri) which is connected to the output side and from which permeate is drawn continuously at will, a feed-back line (Ri) and a discharge (Ab) for excess concentrate. It is characterised by a pump control (PR) which is functionally connected to a pressure sensor (P1) for measuring the pressure in the ring line (Ri), as well as a concentrate control (KR) which is functionally connected to two flowrate sensors (S1, S2) and two control valves (V1, V2). The quantities of concentrate fed back or discharged are controlled, and the pump is regulated, in such a way that the system efficiency always remains high in spite of a fluctuating amount of permeate drawn off. Energy and water are thereby saved.



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TITLE: Reverse osmosis process for supply of pure water for blood dialysis - uses filter module assembly to separate incoming raw water into filtered pure water and unfiltered water contg. conc. residues, etc.

INVENTOR: SCHAE, W

PATENT-ASSIGNEE: SCHAE W[SCHAE]

PRIORITY-DATA: 1995DE-1020912 (June 8, 1995)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
DE 19520912	A1 December 19, 1996	N/A	010	<u>C02F 001/44</u>

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PUB-NO	APPL-DESCRIPTOR	APPL-NO	APPL-DATE
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INT-CL (IPC): B01D061/12, C02F001/44 , G05D021/00

ABSTRACTED-PUB-NO: DE 19520912A

BASIC-ABSTRACT:

The reverse osmosis process uses a filter module assembly to separate incoming raw water into filtered pure water (permeate) and unfiltered water contg. conc. residues. A pipe returns a varying proportion of the concentrate to the incoming flow of raw water, while the balance of the concentrate is discharged to a drain. The quality of permeate generated is adjusted as required by a flow-control valve (17) incorporated in the pipe taking concentrate from the filter module. An increase in the concentrate release from the filter module is linked by means of a supplementary control assembly to a redn. in the concentrate released to the drain.

USE - Used to supply pure water for use in blood dialysis. The automatic change in the operating position of the flow-control valve is linked to a measurement of the pressure in the permeate outlet pipe, and maintaining this pressure at an approximately constant level. When the aperture in the flow control valve is widened to reduce the resistance to flow, additional concentrate is released.

ADVANTAGE - The process provides a simple means of adjusting the supply of pure water permeate to meet the current requirement.

CHOSEN- Dwg.1/3

DRAWING:

TITLE- REVERSE OSMOSIS PROCESS SUPPLY PURE WATER BLOOD
TERMS: DIALYSE FILTER MODULE ASSEMBLE SEPARATE INCOMING
RAW WATER FILTER PURE WATER UNFILTERED WATER
CONTAIN CONCENTRATE RESIDUE

DERWENT-CLASS: D15 J01 S05 T06

CPI-CODES: D04-A01E; J01-C03A;

EPI-CODES: S05-G01A; T06-B06;

SECONDARY-ACC-NO:

CPI Secondary Accession Numbers: C1997-017785

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Claims of DE19520912

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1. Procedure for the regulation of a reverse osmosis plant, which a filter module exhibits for the separation from supplied Rohwasser in filtered pure water (Permeat) and unfiltriertes waste water (concentrate) and mechanisms enriched with held back materials for the feedback of a variable portion of the concentrate into the supply of raw water and the remaining portion of the concentrate into the discharge, by the fact characterized that the produced Permeatfluss is adapted to the respective need by adjustment (first) of a flow resistance (17) in the concentrate line exhausting from the filter module.

2. Procedure according to requirement 1, by the fact characterized that flow resistance (17) is adjusted automatically in such a way by an automatic controller (26), steered by the Permeatdruck, that on changes of the Permeatflusses in the Verbraucherleitung of the Permeatdruck is kept essentially constant.

3. Procedure after one of the preceding requirements, by the fact characterized that with a reduction of flow resistance (17) in the concentrate line exhausting from the filter module arising additional portion ▲ top of the concentrate river is led into the supply of raw water.

4. Procedure after one of the preceding requirements, thereby is adjusted characterized that a second flow resistance (21) is inserted, that into downstream the line connecting from first flow resistance (17) the concentrate line (16b) with the discharge (20a, b), on change of the concentrate river moving in opposite directions to first flow resistance (17).

5. Procedure according to requirement 4, by the fact characterized that the adjustment movements moving in opposite directions for adjustment first and second flow resistance (17 and/or. 21) by an adjustable adapter (29) it is so one on the other tunable that the concentrate river led into the discharge stands in given volumetric relation to the supply of raw water.

6. Procedure according to requirement 4 or 5, by the fact characterized that from the filter module from stepping concentrate river is seized by a

measuring element inserted into the line section (16b) downstream by first flow resistance (17) and second flow resistance (21), inserted into the line leading to the discharge (20a, b), is automatically adjusted as control member as a function of the result of measurement.

7. Device for the execution of the procedure according to requirement 2, characterized by an automatic control loop, which consists standing pressure sensor (25) of with the Permeatleitung (15) in effect connection, an automatic controller (26) and a flow resistance (17), designed of it steered, as regulating valve.

8. Device according to requirement 7, characterized by the functions of the pressure sensor (25), the automatic controller (26) and the regulating valve (17) combining building group (Fig. 3) with an final pressure chamber (41), which by at least one line connection (15a, 15b) with the Permeatleitung is connected, one the diaphragm (43) lying close pressure plate (44) and with the pressure plate connected and with this against Kraft at least one feather/spring (45, 51) a together adjustable tappet (46), the one in the course of the concentrate line (16a, b) lying bottleneck (47) more or less locks the pressure chamber limiting flexible diaphragm (43).

9. Device according to requirement 8, characterized by a rigging device (50) for adjustment Kraft one on the pressure plate (44) influencing feather/spring (51).

10. Device according to requirement 8 or 9, characterized by a rigging device (49) for adjustment the stroke of the tappet (46) of limiting notice (48).

11. Device for the execution of the procedure according to requirement 3, by the fact characterized that for the derivative of the additional portion of the concentrate river downstream the line section (16b), lying of flow resistance (17), stands by a check valve (22) with the raw water pipeline (10), which is exhibiting a small Durchlasswiderstand, at constant pressure, in connection.

12. Device for the execution of the procedure according to requirement 6, by it characterized that the measuring element covers a piston cylinder arrangement (32, 31), with which by flow forces of the Konzentraflusses at a throttle (33) produced a differential pressure on the two sides of the piston (32) works, and which exhibits control member, an axially mobile slidegate valve (35), standing with the piston (32) over a connecting rod (34) in connection, that with one by increase of the differential pressure against Kraft at least one feather/spring (36a, b) movement of the piston, those caused an opening leading to the discharge for the derivative of concentrate over the line section (20b) in the discharge is intended, increasingly fires.



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The invention refers to a reverse osmosis plant after the upper grasp of the principal claim. Such plants are needed among other things in connection with hemodialysis devices, in order to place for the production of the Dialysierflüssigkeit sufficiently pure, as germ-free a water as possible for the order.

The operational principle of reverse osmosis plants consists as well known of the fact that the water in a filter module under high pressure at the surface of a semipermeable diaphragm, which can be prepared, is along- led, whereby a part of the water, which steps and on the other side of the diaphragm is collected and to the consumption places supplied so-called Permeat, by the diaphragm. That by the diaphragm not stepping part of the Rohwassers, the so-called concentrate enriched with held back materials, flows out at the end of the flow distance of the primary area from the diaphragm module.

With the enterprise of reverse osmosis plants, z. B. with the supply, the need at prepared water strong fluctuations can be subject to a dialysis station, so that the plant is charged to capacity often only to a part of its
 ▲ to capacity. From DE 43 31 102 a regulation procedure is well-known, with which the engine performance of the pump serving for the production of the filtration pressure is reduced during decreased extent of utilization, in order to adjust the produced Permeatfluss to the current need value. For this engine performance is regulated in such a way that the pressure dominant in the Permeatleitung leading to the consumption places remains constant.

For the increase of the relationship between the produced Permeatvolumen and the raw water volume for this used it is well-known to return a part of the concentrate flowing off from the filter module into the supply of raw water and to reject only the remaining part by deriving into the discharge. The led back concentrate portion may not exceed thereby however a certain border dependent on the degree of pollution of the Rohwassers, in order to avoid a damage of the filter diaphragm. In DE 43 31 102 it is for this suggested to measure the reconducted and the concentrate portion derived

into the discharge by two concerned flow sensors arranged in the lines and in such a way to steer via an automatic controller (concentrate automatic controller) two regulating valves inserted into the same lines as a function of the measured flow that only a maximally permissible quantity concentrate is led back. Affect the concentrate automatic controller for further refinement the rule character target the pressure than additional Steuergrösse, measured on the primary winding of the filter diaphragm, in a way not specified in more detail.

The invention was the basis the task to equip a reverse osmosis plant in such a way that a automatic adjustment of the Permeaterzeugung is reached to the need with simple means.

This task is solved by the characteristics indicated in the characteristic part of the principal claim. Further characteristics and arrangements of the invention, those and. A. a automatic adjustment of the concentrate feedback on changes of the extent of utilization of the plant concern, result from the Unteransprüchen and the following description of remark example in connection with the illustrations.

It shows

Fig. 1 the pattern of a reverse osmosis plant with equipment characteristics according to the invention,

Fig. 2 a schematic sectional view of a mechanism for the reduction of the concentrate discharge with rising entire - Konzentrafluss,

Fig. 3 a schematic sectional view of an automatic controller for the regulation of the Permeatdruckes.

The mechanism of a reverse osmosis plant with organization characteristics according to the invention is purely schematic in Fig. 1 represented. The Rohwasser supplied by way of the line 10 with constant low pressure arrives over the pump 11 and the line 12 into the filter module 13, whose primary area 13a is separate by a semipermeable diaphragm 14 from the secondary area 13b. From the secondary area the Permeat flows into the Verbraucherleitung 15.

The concentrate flows from the exit of the primary area of the filter module over the line 16a, b to a flow divisor 18, which leads back a part of the concentrate over the line 19a, b into the raw water pipeline and leads the remaining part over the line 20a, b into the discharge. A regulating valve 17 inserted between the line sections 16a and 16b essentially determines the pressure dominant in the primary area of the filter module, which is necessary for the filtration.

The flow divisor 18 exists in principle of two flow resistances 21 and 22, from their resistance relationship the relationship between the reconducted and the concentrate portion led into the discharge depends. In a simple execution form of the invention flow resistance 21 leading to the discharge is as adjustable, in the rest of however constant flow resistance, z. B.

trained in form of an adjustable throttle. Flow resistance 22 standing with the supply of raw water in connection is thereby a check valve, which opposes a relatively slight resistance to the flow in the opened condition.

With reverse osmosis plants it is frequently intended after the state of the art that a surplus part of the Permeats can be led back into the supply of raw water. Serves this purpose in Fig. 1 the Permian RK feedback line 23 in connection with the valve 24. Such an arrangement is suitable under anderm one to prevent in troubles an excessive increase of pressure in the Verbraucherleitung 15.

The invention plans that the flow resistance of the regulating valve 17 arranged in the concentrate line is adjusted in such a way as a function of in the Permeatleitung dominant pressure that also with varying Permeatbedarf the pressure remains essentially constant in the Permeatleitung or only in small measure rises. For this purpose a pressure sensor 25 is attached to the Permeatleitung 15, which steers the valve 17 via an automatic controller 25. The pressure control works in such a way that during decreased removal by Permeat over the line 15 and rising tendency of the Permeatdruckes the valve 17 is thus continued to open. Thus the pressure in the primary area 13a of the filter module sinks, and it crosses an accordingly smaller quantity of Permeat by the diaphragm 14 into the secondary area 13 b.

That as Permeat by the diaphragm not stepping water remains in the primary area and withdraws additionally by the line 16a, b from the filter module. According to the promotion characteristic (p-q-characteristic) of the pump 11 the promotion rate of the pump 11 rises on by the pressure relief, which arises as a result of further opening of the valve 17, which leads to a further increase of the concentrate river in the line 16a, b.

In Fig. 1 represented arrangement for the controlling of the valve 17 as a function of in the Permeatleitung dominant pressure can be carried out in the way that as pressure sensor 25 electrically, z. B. piezoresistiver pressure sensor is used and the valve 17 as valve adjustable of an electrical engine is trained, whereby the signal transmission takes place from the pressure sensor on the engine with consideration of a given desired value of the Permeatdruckes via the automatic controller 26.

If the automatic controller continues to open the valve 17 due to an increase of pressure signaled by pressure sensor 25, the tendency actually exists because of the increased account stepping river that the pressure in the line section 16b rises. This is prevented however to a large extent, if flow resistance 22 is designed as check valve, which already continues to open with slight increase of pressure and which surplus over the line section 16b flowing liquid derives over the line 19 into the supply of raw water 10, in which normally a constant low pressure prevails.

During decreased extent of utilization of the plant the reconducted portion of the concentrate rises in desirable way considerably, D due to the

described connection. h. the portion of the reconducted concentrate of the entire concentrate river is increased. That the discharge supplied portion of the concentrate remains approximately constant against it during constant attitude of flow resistance 21, because the pressure in the line section 16b, which is effective as input pressure at flow resistance 21, due to which characteristics of the check valve 22 the not substantially over preset pressure in the raw water pipeline rise can.

By the pressure drop in the primary area of the filter module during decreased extent of utilization of the plant the load of the pump 11 and thus the capacity of their driving motor decrease. This is because of the attainable energy conservation advantage-has. Beyond that is this effect of importance, whom the pump is designed as submerged pump, with that the cooling of the driving motor takes place via the water promoted by it. The reduced capacity facilitates the maintenance of sufficiently low temperatures despite by for decreased extent of utilization of the plant of caused dropping of the supply of raw water.

In further arrangement of the invention is intended to lower in connection with the increase of the concentrate return flow the concentrate river derived into the discharge if the Permeatdruck rises and thus in the line the 16a, b increases arising total concentrate river. For this purpose flow resistance 21 equipped as adjustable throttle with an electrical adjustment engine 28 is. The attitude of the throttle takes place automatically via the fact that the automatic controller affects 26 over the adapter 29 also the adjustment engine, whereby the valve 17 and the throttle 21 are moving in opposite directions operated. Between one by adjusting the valve 17 it caused change of the entire of concentrate river and the associated, change moving in opposite directions of the concentrate discharge caused by adjusting the throttle 21 exists a quantitative relationship which is essentially determined by the adjusting characteristic of flow resistances 17, 21 and the transfer function of the adapter 29 and is so adjustable that at changing extent of utilization of the plant always an optimal utilization of the supplied Rohwassers takes place.

A special device for the controlling of the concentrate of discharge as a function of the total concentrate river is in Fig. 2 schematically represented. It essentially consists of a cylinder piston arrangement in connection with a throttle to the production of one of the flow in the line 16a, b dependent adjusting force, which adjusts the valve 21 leading to the discharge. At the top side of the piston 32 stored adjustably in the cylinder 31 the concentrate which can be distributed on the supply of raw water and the discharge flows too over the line 16b. It flows by an adjustable bottleneck 33, which works as throttle, into the area underneath the piston and from there on the one hand over the connection 19a and (here not shown) a check valve to the supply of raw water, on the other hand over the valve 21 into the line 20b leading to the discharge. With increasing supply of concentrate over the line 16b rises Kraft, so that over the connecting rod 34

the slidegate valve 35 is shifted downward against Kraft of the feathers/springs 36a, affecting the piston 32, b and thus the flow resistance of the valve 21 is increased, which leads to the intended reduction of the concentrate portion led into the discharge. With the remark with play shown here the slidegate valve 36 provided with drillings 37 is, by which a part of the concentrate flows into the area underneath the slidegate valve. With increasing movement of the slidegate valve by the lower edge of the slidegate valve the opening is increasingly locked downward to the line 20b leading to the discharge.

The characteristic of the arrangement after Fig. 36b and the flow resistance of the throttle 33 depend 2 on the tensile state of the feathers/springs 36a and. The basic portion of the concentrate river exhausted into the discharge and the relationship between an increase of the total concentrate river and the associated acceptance of the portion in the sense of an optimal utilization of the Rohwassers, exhausted into the discharge, can be varied by attitude of these parameters. For this appropriate rigging devices 38 and 39 are intended.

In Fig. it is characterised 2 represented arrangement by the fact that their function does not depend on precision construction units. Among other things the piston 32 and the slidegate valve 35 may have relatively large play in the associated cylinders. Since in addition the transmission as measuring signal of the working Kraft without seal elements takes place, the system works practically frictionlessly, so that good reproducibility and working reliability are given.

Fig. schematically the structure of a hydraulic automatic controller, that shows 3 in accordance with a further arrangement of the invention the function of the parts of 17 and 25 to 27 of Fig. 1 takes over. In a valve body 40 is located the pressure chamber 41 over connections 15a, b with the Permeatleitung in connection, preferably in such a way that the connections are 15a, b a component of the Permeatleitung and the entire Permeat flows by the area 41. The area 41 is separate from the area 42 by a wasserundurchlässige flexible diaphragm (rubber below) 43. The pressure plate 44 lies close to the diaphragm on the side of the area 42, which is pressed by a feather/spring 45 against the diaphragm. In the same valve body is a flow channel 16a, b for the concentrate in continuation of the identically designated line sections (S., flowing off from the filter module. Fig. 1). This channel exhibits a bottleneck 47, which is more or less locked on change of the Permeatdruckes by 44 tappets 46 connected with the plate. The bottleneck 47 in connection with the tappet 46 corresponds to the valve 17 in its function. A notice 48 adjustable with the rigging device 49 permits it to limit the rule stroke. Beyond that the equilibrium position of the system is and thus the desired value of the Permeatdruckes changeable by means of the rigging device 50, by Kraft of the feather/spring 51, which influences by the diaphragm through on the plate 44, one changes. The draft response is affected of the resulting spring rates of the two

feathers/springs 45 and 51.

The area 42 at the lower surface of the diaphragm 43 stands by a channel 52 with the line section 16b in connection, so that adjusting force the affecting the plate 44 is determined by the difference of pressure between the Permeatleitung and the line section 16b of the concentrate line. Since the latter can be kept essentially constant however, as described before, influence can be by an appropriate constant portion of the resulting Kraft of the feathers/springs 45, 51 to be compensated.



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1. Reverse osmosis plant with at least one diaphragm module (10), which at the input side attached to feeding water a leading inlet (2) with a pump (5) and at the output with a Permeatleitung (15) is connected, those to at least one consumer (16, 17) leads, whereby into the Permeatleitung (15) a controllable valve (34) is intended, and with a control device (20), to those at the input side at least into the Permeatleitung (15) arranged conductivity measuring cell (24) as well as downstream the valve (34) in the Permeatleitung arranged pressure sensor (37, 38), and with one from the diaphragm module (10) prominent are attached Concentrate line (25), by the fact characterized that a Permeatrückführleitung (40) with one of the control device (20) is intended controllable valve (41), which branches of the Permeatleitung (15) currentup the valve (34) and flows on the suction face of the pump (5) into the inlet (2).

2. Reverse osmosis plant according to requirement 1, by the fact characterized that into the Permeatrückführleitung (40) in the direction of the Permeatleitung (15) a closing check valve (43) is intended, which is arranged preferably close of the delta into the inlet (2).

▲ top 3. Reverse osmosis plant according to requirement 1 or 2, by the fact characterized that into the Permeatrückführleitung (40) a further valve (49), preferably an ascertainable valve is intended.

4. Reverse osmosis plant after one of the requirements 1 to 3, by the fact characterized that downstream the controllable valve (34) in the Permeatleitung (15) an accumulator (21) is intended, preferably a diaphragm receiver.

5. Reverse osmosis plant according to requirement 4, by the fact characterized that between the controllable valve (34) and the accumulator (21) a check valve (39) is arranged.

6. Reverse osmosis plant according to requirement 5, by the fact characterized that the pressure sensor (37, 38) is arranged downstream the check valve (39) and these the control device (20) a first signal with

reaching an upper threshold value and a second signal transmits with reaching a lower threshold value.

7. Reverse osmosis plant after one of the preceding requirements, by the fact characterized that to the Permeatleitung (15) a Permeatablauf (27) with a control valve (29), arranged therein, is attached.

8. Reverse osmosis plant after one of the preceding requirements, by the fact characterized that to the Permeatleitung (15) a Permeatablauf (13) with a pressure relief valve (46), arranged therein, is attached.

9. Reverse osmosis plant according to requirement 7 or 8, by the fact characterized that the Permeatablauf (13, 27) between the conductivity measuring cell (24) and the branching of the Permeatrückführleitung (40) is attached.

10. Reverse osmosis plant after one of the requirements 7 to 9, by the fact characterized that between the diaphragm module (10) and the connection of the Permeatablaufs (27) toward the diaphragm module (10) closing check valve (22) it is intended.

11. Reverse osmosis plant after one of the preceding requirements, thereby characterized that in the Permeatleitung (15) a flow meter (23) is arranged, preferably currentup the conductivity measuring cell (24).

12. Reverse osmosis plant after one of the preceding requirements, by the fact characterized that in the inlet (2) on the suction face of the pump (5) a pressure sensor (14), connected with the control device (10), is intended.

13. Reverse osmosis plant after one of the preceding requirements, by the fact characterized that in the inlet (2) a controllable valve (11) is intended.

14. Reverse osmosis plant after one of the preceding requirements, by the fact characterized that the concentrate line (25) is branched to an expiration of concentrate (48) and a concentrate feedback (47), whereby the concentrate feedback (47) flows into the inlet (2) on the suction face of the pump (5).

15. Reverse osmosis plant according to requirement 14, by the fact characterized that in each case in the expiration of concentrate and in the concentrate feedback (47) a valve (32, 33) is arranged, preferably a by hand adjustable valve.

16. Reverse osmosis plant according to requirement 14, by the fact characterized that in the expiration of concentrate (48) downstream the valve (33) a flow meter (44) is arranged.

17. Reverse osmosis plant after one of the preceding requirements, by the fact characterized that at least one equipment (4, 8, 9, 26, 31, 36) is intended to the printer version and announcement.

18. Procedure for the enterprise of a reverse osmosis plant, with which by means of a pump (5) feeding water is supplied to a diaphragm module (10), from the Permeat on the one hand and concentrate is on the other

hand removable, whereby the Permeat is supplyable at least one consumer (16, 17) and in accordance with condition of at least two initial parameters a control device of output signals produced, which serve for heading for the pump drive (6) and from valve means; thereby marked that the respective pressure is measured in the Permeatleitung (15) and an appropriate signal is given to the control device (20), in such a manner that with reaching an upper pressure level the valve means (34) in the Permeatleitung (15) closed and simultaneously that Valve means (41) is opened in the Permeatrückführleitung (40), whereby the Permeat of the inlet (2) on the suction face of the pump (5) is supplied, so that the pump (5) beside the feeding water and the reconducted concentrate promotes also the reconducted Permeat.

19. Procedure according to requirement 18, by the fact characterized that with reaching a lower pressure level into the Permeatleitung (15) the Permeatrückführleitung (40) and the Permeatleitung (15) is closed is opened to the consumers (16, 17) again.

20. Procedure according to requirement 18, by the fact characterized that the pump (5) is switched off after a certain time preselectable at the control (20) and the valve means (29) briefly opens at the same time and again closes.

21. Procedure according to requirement 20, by the fact characterized that with reaching a lower pressure level into the Permeatleitung (15) the pump (5) again it connects.

22. Procedure after one of the preceding requirements, by the fact characterized that when falling below one at the controlling (20) of preselectable Permian RK conductivity value, which by the conductivity measuring cell (24) to the control (20) one conveys, the Permeatrückführleitung (40) is closed and the Permeatleitung (15) is opened to the consumers (16, 17).


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The invention concerns a reverse osmosis plant with at least one diaphragm module in the generic term of the requirement 1 indicated kind as well as a procedure for the enterprise of such a reverse osmosis plant in accordance with the generic term of the requirement 18.

Well-known reverse osmosis plants cover one or more diaphragm modules, which are supplied via an inlet with feeding water. In order to produce an appropriate pressure, a pump is intended in the inlet, which provides at the output not only for an appropriate pressure gradient at the diaphragm, but also an appropriate pressure in one on the diaphragm module attached Permeatleitung. The Permeatleitung leads to one or more consumers; that are supplied if necessary via adjustable valves with the quantity of the Permeats needed in each case. In the Permeatleitung is intended a conductivity measuring cell, which are connected with a control device, so that in dependence of the respective quality of the Permeats on the enterprise of the reverse osmosis plant influence can be taken. If no Permeatanforderung is present by one the consumer, the pump is switched off, i.e., the reverse osmosis plant is operated intermittent in dependence of the consumption requirements. In order to improve the operating conditions, already one suggested arranging within the range of the Permeatleitung before the consumers an accumulator so that a certain Permian at tightness within a certain pressure range is kept ready, if the pump is switched off. In this way brief Permeatentnahmen is also possible during the stop of the pump or also in their start-up phase.

It turned out however that with such a plant the quality of the produced Permeats large fluctuations is subjected. Under concentration reconciliation of the salts over the diaphragm with stop of the pump the quality of the Permeats is worse within a certain time period after each Zuschaltung than in the operating condition after the start-up phase. Under the strongly varying consumption requirements it comes to frequent and switching of the plant off, which causes finally everyone times the separation of the Permeats of insufficient quality, until a stationary operating condition at the

diaphragm adjusted itself, which is the condition for the production of a Permeats with according to low conductivity.

The available invention is the basis the task to create a reverse osmosis plant in the generic term of the requirement 1 indicated kind with which the work intervals are reduced and which quality of the produced Permeats is increased. In addition the invention the task is the basis to indicate a procedure for the enterprise of such a reverse osmosis plant.

This task is solved by a reverse osmosis plant with the characteristics of the requirement 1 as well as by a procedure with the characteristics of the requirement 18.

The substantial advantages of the invention are to be seen in the fact that
▲ to the switching frequency clearly reduced and so that an enterprise stationary over longer operating phases is reached, whereby the Permeatqualität is crucially improved. By feedback Permeats and feed on suction face pump results in itself thus Permeatkreislauf, by which sinking conductivity concentrate takes place, whereby guaranteed is that in the operating cases, in which the pump is actually switched off a small diffusion downward gradient is present, so that also when restarting the plant a better quality of the Permeats is present. An additional concentrate displacement is not necessary.

If no requirement of Permeat is present on the part of the consumers, then the produced Permeat is attributed completely to the suction face of the pump. This has the consequence that concentrate from the diaphragm module is only exhausted, in same quantity as in the normal enterprise with Permeatabgabe to the consumers. The supply takes place at feeding water in the quantity, in which also concentrate is exhausted. In this way the concentrate in the module accepts very fast the quality of the feeding water, whereby the otherwise usual concentrate displacement, which takes place for example via a separate rinsing process with feeding water in the switched off condition of the plant, is not necessary.

So that it is guaranteed that into the Permeatrückführleitung exclusively from the Permeatleitung outgoing to the inlet Permeat flows, in no case however in the opposite direction, is intended into the Permeatrückführleitung a check valve, which is arranged preferably close of the delta of the Permeatleitung into the inlet. An ascertainable valve, which is arranged in the Permeatrückführleitung between the placable valve and the check valve, ensures the printer attitude in the Permeatleitung.

In order to maintain and a limited quantity of the Permeats independently of the respective operating condition of the reverse osmosis plant keep in the Permeatleitung leading to the consumers a certain minimum pressure available, appropriately downstream the controllable valve in the Permeatleitung an accumulator, preferably a diaphragm receiver, is intended. So that with the pressure gradient arising by switching the pump off from the diaphragm receiver to the diaphragm module a back flow of the

Permeats is prevented, a check valve is arranged between the controllable valve and the accumulator.

Into the Permeatleitung pressure sensor present appropriately downstream the check valve and gives the control device a first signal the threshold value lower with reaching an upper threshold value and a second signal with reaching is arranged. Thus the upper and the lower threshold value define a pressure range between the minimum to upright-hold pressure and the maximum pressure of the diaphragm receiver.

So that when switching the pump off no pressure gradient of the Permeatseite to the feeding side the diaphragm develops - this would lead to the destruction of the diaphragm - is to the Permeatleitung a first Permeatablauf with a control valve arranged therein which opens when switching the pump off briefly, intended.

Between the diaphragm module and the Permeatablauf are into the Permeatleitung a check valve, which closes toward the diaphragm module, a flow meter, that the produced Permian at tightness indicates and a conductivity measuring cell for the transmission of the Permeatleitfähigkeit to the control arranged.

For the case of the mechanical destruction of the diaphragm a second Permeatablauf with a relief valve, which opens with an inadmissible increase of pressure, arranged therein, is intended to the Permeatleitung behind the first Permeatablauf.

As further parameters for the production of appropriate control signals in the control device the pressure of the feeding water in the inlet can be considered. For this an appropriate pressure sensor is intended in the inlet on the suction face of the pump. The pressure sensor in the inlet for the suction face of the pump steers beside the pressure sensor into the Permeatleitung the work of the pump. With an inadmissibly low Einspeisedruck or with being missing Permeatanforderung after temporary Permeatrückführung switches off the pump and closes the controllable valve in the inlet.

The concentrate line leading from the diaphragm module is preferably in an expiration of concentrate and a concentrate feedback branches out, whereby the concentrate feedback flows into the inlet on the suction face of the pump. In order to be able to stop the quantity of the reconducted concentrate and the concentrate which can be separated from the reverse osmosis plant, preferably by hand an adjustable valve is arranged in each case in the expiration of concentrate and in the concentrate feedback. For the announcement of the quantity of the concentrate separated by the expiration of concentrate a flow meter is arranged in the expiration of concentrate. In order to indicate the pressure level dominant at certain points in the line system of the reverse osmosis plant, devices are intended to the printer version and announcement.

A remark example of the invention is below described on the basis the

design, which shows a reverse osmosis plant with a diaphragm module in schematic representation, more near.

The reverse osmosis plant represented in the design is attached with an inlet 2 at a feeder 1, in which a guard filter 3 is arranged. For the statement of the pressure in the feeder 1 a pressure indication 4 is intended. In the inlet 2 is a pump 5, which increases the pressure in the inlet 2, so that the liquid with an accordingly high pressure level is supplied to a diaphragm module 10 attached on the print page of the pump 5. The pump 5 is coupled with a driving motor 6. The driving motor 6 is connected by means of a control line 6' with a control device 20, which produces control signals, which are supplied to the driving motor 6 in dependence of several initial parameters.

In order to determine the respective pressure level both on the suction face and on the print page of the pump 5, pressure indications 8 and 9 in the inlet 2 are intended. In order to affect and if necessary also lock the inflow off from feeding water to, a valve 11 is arranged in the inlet 2, which is provided with a valve drive 12. The valve drive 12 stands over a control line 12' with the control device in connection. Furthermore a pressure sensor 14 is intended in the inlet 2, which is connected by a holding wire 14' with the control device 20.

A Permeatleitung 15 is at the output attached at the diaphragm module 10, which leads to an accumulator 21, which is preferably a diaphragm container. With the accumulator 21 consumers 16 and 17 are connected, whereby the appropriate feeder line by means of valves 18 and 19 lock offable and/or. the depressing cross section is controllable. Of course also the possibility exists of attaching only one consumer or more than two consumers.

On the basis of the diaphragm module 10 first a check valve 22 in the Permeatleitung 15, which closes the flow in the direction of the diaphragm module 10, is. Downstream the check valve 22 a flow meter 23 is intended, by which the respective flow rate is determined. Downstream the flow meter 23 is intended into the Permeatleitung 15 a conductivity measuring cell 24, which is connected by a holding wire 24' with the control device 20. In the section in the Permeatleitung 15, following to the conductivity measuring cell 24, a connection of a first Permeatablaufs 27 is intended, which flows into a channel 30. In the Permeatablauf 27 a valve 29 with a valve drive 28, which is connected by a control line 28' with the control device 20, is.

In the same section of the Permeatleitung 15 the connection of a second Permeatablaufs 13 is intended, which likewise flows into the channel 30. In the Permeatablauf 13 a relief valve 46 for security, which opens during excess of a permissible maximum pressure, is.

So that the pressure dominant within the range of the branching of the two Permeatabläufe 13 and 27 is seized and indicated, a pressure indication 26

is intended. In flow direction of the Permeats is arranged 34 with a valve drive 35 into the Permeatleitung 15 a valve, which is connected by a control line 35 ' with the control device 20. Downstream the valve 35 is a check valve 39, which closes a current reversal in the direction of the valve 34 and thus from Permeat contained in the accumulator 21 toward to the diaphragm module 10 prevented.

The pressure which is applied in the accumulator 21 is indicated by means of a pressure indication 36. This pressure is seized also by means of two pressure sensors 37 and 38, which are switched by means of signal lines 37 ' and 38 ' to the control device 20. The pressure sensor serves 37 for the production of an appropriate signal with reaching a maximally given pressure, whereas the pressure sensor gives with reaching a lower pressure level an appropriate signal to 38 to the control device 20.

From the Permeatleitung 15 a Permeatrückführleitung 40 branches within the range between the connection of the Permeatablaufs 13 and the valve 34, which leads on the suction face of the pump 5 and flows there into the inlet 2. This Permeatrückführleitung 40 is provided with a valve 41, which is operatable by means of a valve drive 42, which exhibits a control line 42 leading to the control device 20 '. In the Permeatrückführleitung 40 is a check valve 43, which makes possible excluding a Permeatströmung of the Permeatleitung 15 in the direction of the inlet 2 and closes in the opposite direction.

This check valve 43 is arranged appropriately close of the delta of the Permeatrückführleitung 40 into the inlet 2.

Between the valve 41 and the check valve 43 an ascertainable valve 49 is in the Permeatrückführleitung 40, with which the pressure in the Permeatleitung 15 can be held.

From the diaphragm module 10 a concentrate line 25 is led out, at which a pressure indication 31 is attached. The concentrate line 25 branches out to a concentrate feedback 47 and an expiration of concentrate 48, whereby latter to the channel 30 leads, to which also the Permeatabläufe 13 and 27 flows. In the expiration of concentrate 48 a hand valve 33 and this is subordinate a flow meter 44 intended. With the help of the hand valve 33 the desired quantity of the concentrate, which is to be separated by the expiration of concentrate, can be stopped, whereby the actually exhausted quantity of the flow meter is ascertainable 44.

The concentrate feedback 47 leads to the inlet 2, on the suction face of the pump 5. Before the integration of the concentrate feedback 47 into the inlet 2 a check valve 45 is intended, which permits and in the opposite direction closes only a flow toward to the inlet 2. Thus it is prevented that feeding water from the inlet 2 into the concentrate feedback 47 arrives. With the help of the hand valve 32 the reconducted quantity of the concentrate can be stopped.

If the pressure level in the accumulator 21 falls below a given minimum

pressure, by the Drucksensoren DP N=10 or 38 an appropriate signal is given to the control device 20, which produces an output signal for the controlling of the driving motor 6, which propels the pump 5. The pump 5 causes an increase in pressure in the pressure-lateral line section in relation to the suction-side line section, whereby the relatively lower suction-side pressure is indicated by means of the pressure indication 8 and the higher pressure on the pressure side of the pump 5 by the pressure indication 9.

In the diaphragm module 10 Permeate is produced, which is supplied to the accumulator 21 by the Permeatleitung 15. The Permeatqualität is seized by means of the second conductivity measuring cell 24 and an appropriate signal to the control device 20 is given. If the Permeatqualität does not correspond to the given requirements, then the valve 34 by means of the valve drive 35 is closed and at the same time the valve 41 by means of the valve drive 42 is opened, so that the Permeate of insufficient quality is led across the Permeatrückführleitung 40 to the suction face of the pump 5.

If the conductivity measuring cell 24 states the fact that the quality of the Permeate corresponds to the requirements is closed the valve 41 and opened at the same time the valve 34, so that Permeate is led into the accumulator 21. Depending upon consumption requirement by one of the consumers 16 or 17 becomes alternatively the valves 18 and/or. 19 opened and Permeate from the Permeatleitung 15 the consumers 16, 17 supplied. If the quantity consumed is smaller than the quantity in the diaphragm module 10 produced Permeates, then an increase in pressure takes place in the accumulator 21, in which a given volume of the Permeates is thus available in a given pressure range.

The concentrate developing with the reverse osmosis is led across the concentrate line 25 from the diaphragm module 10, whereby depending upon attitude of the valves 32 and 33 a portion is separated by the expiration of concentrate 48 and a portion is reconducted by the concentrate feedback 47 into the inlet 2 on the suction face of the pump 5.

With reaching the maximum pressure in the accumulator the pressure sensor 37 gives an appropriate signal to the control device 20, which thereupon the valve 34 closes and at the same time opens the valve 41 in the Permeatrückführleitung 40, so that in the diaphragm module 10 produced Permeate on the suction face of the pump 5 into the inlet 2 one leads. Thus a Permeatekreislauf results, into which operating phases, in which no Permeateanforderung or a small Permeateverbrauch is only present on the part of the consumers 16, 17. While the produced Permeate is led completely in a cycle, however further concentrate from the diaphragm module 10 by the concentrate line 25 flows and the expiration of concentrate 48 to the channel 30, in the same quantity as with the enterprise with Permeatabgabe to the consumers and/or. the accumulator 21. Since the supply takes place at feeding water in same quantity, the concentrate in the module accepts very rapidly the quality of the feeding water, so that an additional rinsing procedure is not necessary for the

concentrate displacement.

During requirement of Permeat by the consumers 16, 17 the pressure in the accumulator 21 sinks and thus also in the neighbouring section of the Permeatleitung 15, which leads to it that the control device 20 closes at the same time the valve 41 and opens the valve 34, thus in the diaphragm module 10 produced Permeat the consumers 16, 17 and/or. one supplies to the accumulator 21. Since the pump 5 was constant during this time, in which the Permeatrückführung took place, in enterprise, has itself the Permeatqualität, which is determined by the conductivity measuring cell 24, not unfavorably changes, so that the Permeat is immediately to the consumers 16, 17 at the disposal.

During a certain period of the Permeatrückführung preselectable at the control 20 if no Permeat is needed and the pressure level in the accumulator 21 remains stable, then the control device 20 causes a Stillsetzung of the driving motor 6 and thus the pump 5. At the same time the valve 29 by the drive 28 is opened briefly, in order to diminish the pressure harmful for the diaphragm in the module 10. A small Permeatvolumen runs thus from the Permeatleitung 15 into the channel 30. Since during the pre-determined time interval of the Permeatrückführung the concentrate in the diaphragm module was diluted at least to a large extent, good conditions are present for the restart, by which directly or very rapidly the demanded Permeatqualität is given.

If the reverse osmosis plant receives a requirement with stop of the pump 5 from Permeat, the plant changes first into the operating condition of the Permeatrückführung, whereby the Permeat is so long led back, until the conductivity - determines by the conductivity measuring cell 24 - which falls below permissible maximum value. Subsequently, the Permeat flows again toward accumulator 21 and consumers 16, 17. In the time between the requirement of Permeat and that open the valve 34 the Permeat out of the accumulator 21 one takes. The pressure sensor 38 supervises the withdrawal from the accumulator 21 and gives an appropriate signal to the Steu< DP N=13> ervorrichtung 20, as soon as the pre-determined lower pressure level is reached.

At best Permeat from the accumulator is available for the entire duration of this starting process. If the lower pressure level is reached, before the permissible maximum value of the conductivity is fallen below, then the consumers 16 and 17 must be supplied either briefly with Permeat of inferior quality or be remained alternatively also without Permeat. In the first case opens valve 34, also with less quality, if the pressure sensor 38 announces a reaching of the lower pressure level. In the second case the plant in the condition of the Permeatrückführung remains and delivers briefly timely no more Permeat.